

# **A Search for Transiting Neptune-Mass Extrasolar Planets in High-Precision Photometry of Solar-Type Stars**

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Tennessee State University operates several automatic photometric telescopes (APTs) at Fairborn Observatory in southern Arizona. Four 0.8 m APTs have been dedicated to measuring subtle luminosity variations that accompany magnetic cycles in solar-type stars. Over 1000 program and comparison stars have been observed every clear night in this program for up to 12 years with a precision of approximately 0.0015 mag for a single observation. We have developed a transit-search algorithm, based on fitting a computed transit template for each trial period, and have used it to search our photometric database for transits of unknown companions. Extensive simulations with the APT data have shown that we can reliably recover transits with periods under 10 days as long as the transits have a depth of at least 0.0024 mag, or about 1.6 times the scatter in the photometric observations. Thus, due to our high photometric precision, we are sensitive to transits of possible short-period Neptune-mass planets that likely would have escaped detection by current radial velocity techniques. Our search of the APT data sets for 1087 program and comparison stars revealed no new transiting planets. However, the detection of several unknown grazing eclipsing binaries from among our comparison stars, with eclipse depths of only a few millimag, illustrates the success of our technique. We have used this negative result to place limits on the frequency of Neptune-mass planets in close orbits around solar-type stars in the Sun's vicinity.

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